Food Safety Information Platform Design Based on Internet of Things

Qiaoqiao Zhang[1], Botao Wang[2]

Beijing University of Technology, Beijing, China

[1]zhangqiaoqiao@emails.bjut.edu; [2]wangbt@bjut.edu.cn

Abstract

Using modern information technology to build a set of food safety information platform based on Internet of things, from raw material production to product marketing, that can make a full range of meat food traceability analysis, to ensure the safety of food industry chain of production, to find and correct the problems in a timely manner. This platform that consists of five system modules is under the framework of IOT, improving the efficiency of the enterprise, reducing costs, promoting enterprise development.

Keywords

Food Safety; Internet of Things; Traceability; Monitoring

Introduction

With the improvement of the standard of human living conditions, we pay more and more attention to nutritional requirements of our food and food safety, especially, the food safety is the important public health problem related to people's health and social stability.

At present, China's food industry is a great potential for development of the industry. However, in recent years, as China's media exposure of a series of major food safety incidents such as "melamine milk", "plasticizer incident", "lean events", food security has become an ongoing topic of public concern. Since the occurrence of H7N9 bird flu in late March 2013, poultry food production enterprises have been encountering unprecedented difficulties, which is a warning for our country.

Installed in poultry food processing, storage, marketing and other processes, sensing devices such as RFID make use of intelligent sensing, through modern information technology, to ensure food hygiene and food safety, reduce disease risks and prevent food poisoning. Since 2003, China has started to apply advanced radio frequency identification technology used in modern farming meat processing enterprises, which developed the RFID real-time production monitoring and management system., Another example in 2005, monitoring the safety of pork traceability system based on RFID technology was put into use in Shanghai formally, and the system that play an RFID tag on pig ears, can real-time access to hog feed, medical records, given medicines, transfer group, quarantine and other information and standardize the process of meat production operations of enterprises, so as to effectively improve the quality and safety of meat products.

In this paper, based on sensor technology and internet of things technology, we proposed the design of food safety information platform in the framework of this network, and analyzed its structure and function respectively. The article firstly introduces the system framework of internet of things. Then food safety information platform is divided into five sub-modules, that are described in detail respectively. Finally, we summarize the characteristics of the system, and its social benefits.

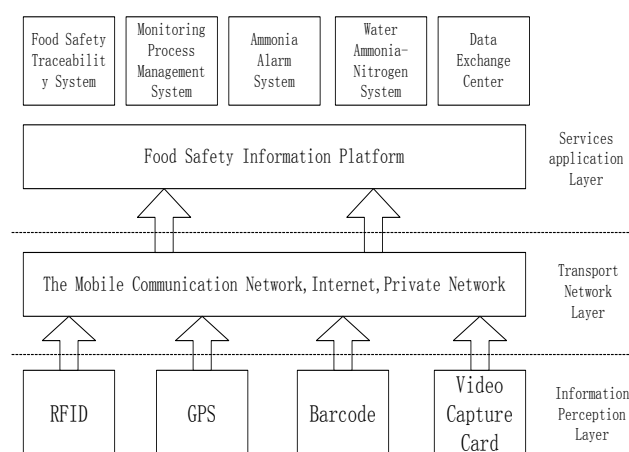## Food Safety Information Platform Structure Design Based on Internet of Things

FIG. 1 FOOD SAFETY INFORMATION PLATFORM STRUCTURE DESIGN BASED ON INTERNET OF THINGS

The initial concept of internet of things made in 1999 by the Massachusetts Institute of Technology, referring to the network relying on radio frequency

identification technology and equipment, according to the agreed protocol and the Internet, can make the items of information interconnection to achieve intelligent identification and management. According to the construction of the content, typical internet of things generally composed of three parts that divided into information perception layer, transport network layer and services application layer as shown in Fig. 1.

Through intelligent devices such as RFID, bar code scanning and two-dimensional codes, the platform can get monitoring data set that was pre-processed. The network layer transport information from the underlying network to service application layer, including mobile communications network, the Internet, satellite network, cable network, and food industry professionals network, and converged network, etc. Transport network layer mainly concern all kinds of network transmission problems caused by data through all types of networks, involving the exchange of intelligent routers, different network transport protocols, self-organization communications and other network technologies. After obtaining the information data from lower layer, the system can provide storage, processing, analysis and query service for us.

The platform utilizes internet of things technology for poultry food safety, and constructs safety traceability system, that is capable of all aspects of being traceable track for feed production, breeding chicks, meat, chicken farming, chicken food production and processing, storage, marketing and other food supply chains. Then it will deal with collected information parameters through real-time uploading, storage, display and alarm. Indeed, to improve system management efficiency, constructing monitoring process management system can enhance safety supervision capacity, simultaneously, as the region's food safe production play a leading and exemplary role.

In order to improve the efficiency of food safety testing, we have a modular platform breakdown, in addition to food safety traceability system and monitoring process management system, adding ammonia alarm systems, water ammonia-nitrogen systems and data center. In food production, processing and sales process, food companies need to be detecting and monitoring ammonia and nitrogen, which are two important indicators of water quality detection of food safety. The data center is a place for storing massive data.

Subsystem Design

Food Safety Traceability System

1) System Function

The system can be geared to the needs of consumers, the enterprise internal staff and safety regulators, realizing information query. If the problems occurred in the food, we can provide a product recall and accountability mechanisms.

According to the target of system, through food safety traceability system, we can be traced back to raw materials for the production of food-related information, including information on the origin of raw materials and production process information. If not getting raw materials production process information, the system can obtain the required raw materials procurement information.

2) System Design

In order to ensure the implementation of food safety traceability, firstly, the food must have identity that is the delivery carrier of food quality and safety of information. Identity can be one-dimensional bar codes, two-dimensional bar codes, RFID tags and other forms.
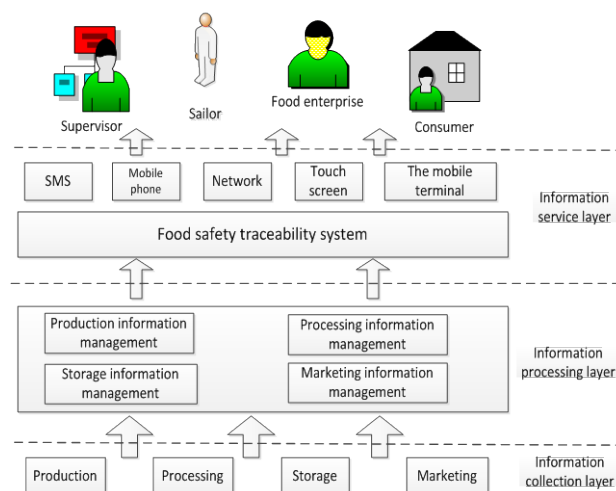

FIG. 2 FOOD SAFETY TRACEABILITY SYSTEM FRAMEWORK

From Fig. 2, we know that food safety traceability system must be adequately covered by feed production, breeding chicks, meat, chicken farming, chicken food production and processing, storage, marketing and other various aspects of the food supply chain, through analyzing all aspects of the business process. Study proposes food quality and safety traceability elements and critical control points. Besides, using relevant national and industry coding standards, we design food safety

traceability chain coding system. on the other hand, making use of information collection and data exchange technology to obtain information on food traceability chain, we will build quality and safety of the consumer process information management system on the basis of food safety traceability platform in food production process, process, storage and transportation process. In order to make consumer-oriented and regulators interactive, improving the efficiency of system implementation, we provide service application interface services based on Web, SMS and telephone.

3) Implementation Process

To ensure food safety, the system mainly makes RFID technology used in chicken food production, processing, transportation, wholesale, retail port inspection and other aspects. Affixed to the packaging of food RFID tags including information on food testing, food growing, generating information and processing information. Through the electronic tag reader traced back to the source of food and other information, the user will be more at ease when buying food.
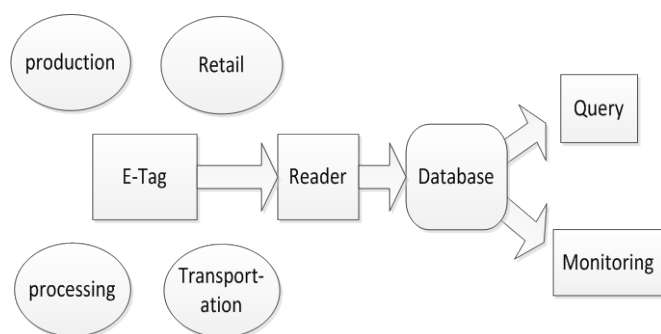

FIG. 3 SYSTEM IMPLEMENTATION PROCESS

For example, in chicken food production and processing of Fig. 3, we will e-label on food or food packaging, and make the reader connected to the antenna integrate sensor. By collecting information on food labels, food traceability system can obtain and verify the food-related information, and it reads data packets to food safety management database over the network. Using food safety traceability system platform, we can provide food safety information services to consumers and regulators through a variety of ways such as web search.

Management inspectors analyze and determine food quality and safety control system. Under this system, checking the safety of food production and

processing, they record results and store it in the database, achieving standardized management of the food production, processing and quality safety information.

Monitoring Process Management System

This system is responsible for the management of food monitoring process. By using this system, operating personnel at the scene of the control room is able to use video real-time monitoring the operation of the production process and bring up the information of production line, that comprehensive guarantee production run smoothly.
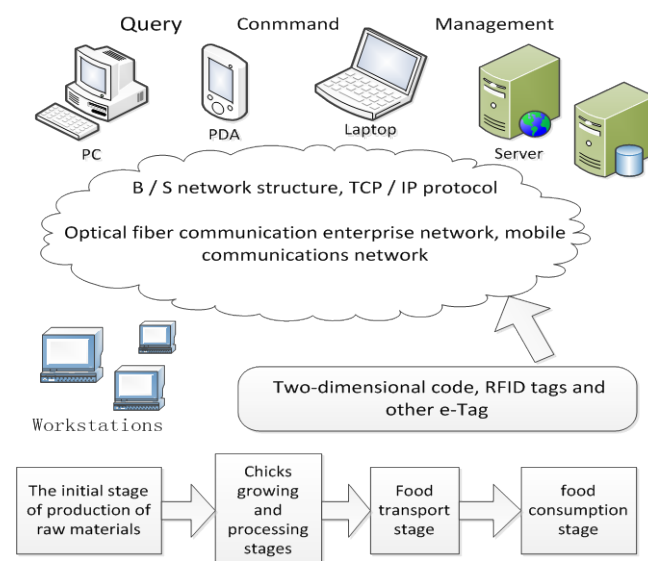

FIG. 4 MONITORING PROCESS MANAGEMENT SYSTEM FRAMWORK

1) System Composition

According to Fig. 4, the whole system is mainly composed of field monitoring terminal, transmission network and the monitoring center. The field monitoring terminal includes monitoring host, two-dimensional code, RFID, cameras, and GPRS communication module. Transmission network realized the mix information communication by optical fiber communication network and mobile communication GSM/GPRS/3g network. The monitoring center is made up of reliable DCN/DDN special line, monitor computer and mobile phone, browser terminal, etc.

2) System Function

Monitoring computer will collect information about food safety, production, processing, transportation and sales. After analysis and

detection, the computer stores the information to local memory. Through the transmission network, the information is also real-time transmitted to the monitoring center. After processing and analysis by the monitoring center of the application server and database server program, the system will displays it on a big screen in the monitoring center for querying, making decisions. The system could also sent text messages to the users' mobile phones. The users can directly browse, query monitoring parameters and the state of objects through the Internet or mobile wireless Internet.

3) System Design

Food production is complicated system engineering. Any quality and safety problems will affect the consumer choice of products, So the process management system is divided into primary raw materials production stage, stage of chicken processing, transportation and consumption and established file management, security monitoring, standards regulations, and alarm monitoring.

The monitoring center has two servers: monitoring the application server and database server. Monitoring application server installs software from the monitoring center, which uses a Web page developed from ASP. Net, Microsoft IIS installed to build Web information publishing system. The database server installs the Windows operating system, and installs the MSSQL database management software and data analysis software. Two servers using network address translation (NAT) technology, there is only one IP for a foreign network.

Due to the systems timeliness strong, monitoring sites scattered, the system is designed to be B/S structure, browsing the Web server in the Web browser directly. Under the TCP/IP protocol, we use the way of Socket connection communication between the monitoring terminal and monitoring center. Sending and receiving data according to the preset good communication protocol. Considering that platform requires dynamic monitoring data sets and creates large amount of data, we use the enterprise optical fiber network as the medium of information transmission.

Platform User

Users of the system can be divided into: food producers, food processors, food distribution companies, consumers and food supervision and management departments, as well as system operation and management agencies.

Conclusions

This paper described the food safety information platform based on Internet of things, which integrates food safety traceability system, monitoring process management systems and other three system modules. This platform can improve tracking, positioning and management of resources, and enhance the food industry automation and overall efficiency. The system is conducive to realize the entire process of food production and quality control, to better protect the legitimate rights and interests of consumers, to ensure the implementation of the food basket project. And the construction of food safety demonstration plays a leading role in promoting employment and increasing national revenue for local economic development.

REFERENCES

A.F.Bollen, C.P.Riden, N.R.Cox. "Agricultural Supply System Traceability", Part I: Role of Packing Procedures and Effects of Fruit Mixing, Bio Systems Engineering, 2007, (98):391-400.

Huoguo Zheng. "Food Safety Traceability System Research. "Chinese Academy of Agricultural Sciences, 2012.

Long Jiang, Jiang Wang. "The Internet of Things Technology Application in the Food Logistics Tracking Design. " Modernizing Agriculture, Kunming University of Science, 2011 (11).

Rui Zhao. "Research and Implementation of Food Safety Monitoring and Control System." North China Electric Power University, 2007.

Yongxiang Li, Jian Zhang. "The Application of Internet of Things in Food Production Design." Science & Technology Vision, Hainan University, 2012(11).